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One-Level density for cubic characters over the Eisenstein field

We show that the one-level density for L -functions associated with the cubic residue symbols χ_n , with $n \in \mathbb{Z}[\omega]$ square-free, satisfies the Katz-Sarnak conjecture for all test functions whose Fourier transforms are supported in $(-13/11, 13/11)$, under GRH. This is the first result extending the support outside the trivial range $(-1, 1)$ for a family of cubic L -functions. This implies that a positive proportion of the L -functions associated with these characters do not vanish at the central point $s = 1/2$. A key ingredient is a bound on an average of generalized cubic Gauss sums at prime arguments, whose proof is based on the work of Heath-Brown and Patterson.

Joint work with Ahmet M. Guloglu.